

3/16/16 "Too many of us are not living our dreams because we are living our fears."-Les Brown

HW: "Function Composition" Homework section

AIM: How do we do compositions of functions?

Warm Up:

**Exercise #1:** A circular garden with a radius of 15 feet is to be covered with topsoil at a cost of \$1.25 per square foot of garden space.

- (a) Determine the area of this garden to the nearest square foot.

$$A = \pi r^2$$

$$A = \pi (15)^2$$

$$A = \pi (225)$$

$$A = 707 \text{ ft}^2$$

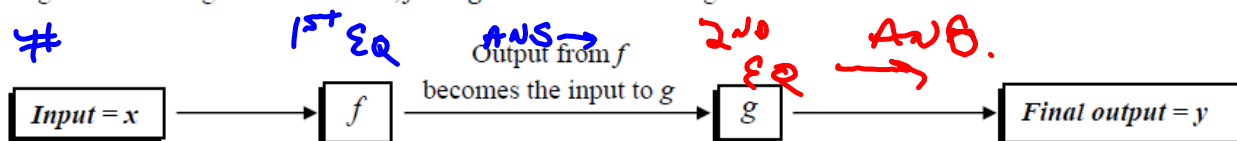
- (b) Using your answer from (a), calculate the cost of covering the garden with topsoil.

$$707 (1.25)$$

$$\$883.75$$

You start out with the first equation and get the first answer. *Substitute this answer into the second equation & get a second answer.*

In this exercise, we see that the output of an area function is used as the input to a cost function. This idea can be generalized to generic functions,  $f$  and  $g$  as shown in the diagram below.



There are two notations that are used to indicate composition of two functions. These will be introduced in the next few exercises, both with equations and graphs.

Exercise #2: Given  $f(x) = x^2 - 5$  and  $g(x) = 2x + 3$ , find values for each of the following.

(a)  $f(g(1)) =$

do g first  
then f.

$$g(1) = 2(1) + 3 = 5$$

$$f(5) = 5^2 - 5 = 20$$

ORIG INPUT  
= 1

FINAL OUTPUT  
= 20

(b)  $g(f(2)) =$

$$f(2) = 2^2 - 5 = -1$$

$$g(-1) = 2(-1) + 3 = 1$$

(c)  $g(g(0)) =$

$$g(0) = 2(0) + 3 = 3$$

$$g(3) = 2(3) + 3 = 9$$

(d)  $(f \circ g)(-2) =$

Do g first  
then f.

$$g(-2) = 2(-2) + 3 = -1$$

$$f(-1) = (-1)^2 - 5 = -4$$

(e)  $(f \circ f)(-1) =$

$$f(-1) = (-1)^2 - 5 = -4$$

$$f(-4) = (-4)^2 - 5 = 11$$

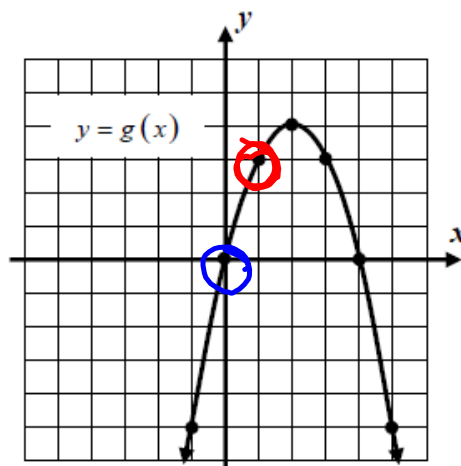
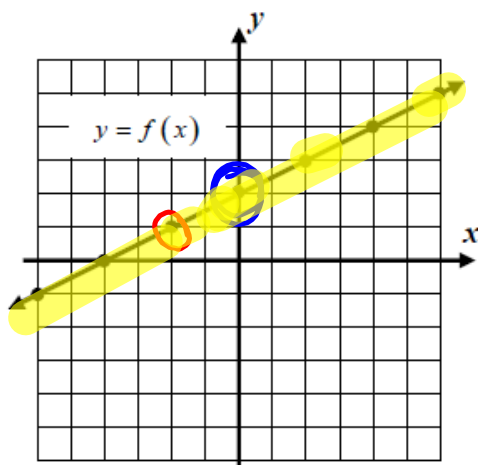
(f)  $(g \circ f)(3) =$

$$f(3) = (3)^2 - 5 = 4$$

$$g(4) = 2(4) + 3 =$$

$$11$$

**Exercise #3:** The graphs below are of the functions  $y = f(x)$  and  $y = g(x)$ . Evaluate each of the following questions based on these two graphs.



(a)  $g(f(2)) = 3$

$f(2) = 3$

$g(3) = 3$

(b)  $f(g(-1)) = -\frac{1}{2}$

$g(-1) = -5$

$f(-5) = -\frac{1}{2}$

(c)  $g(g(1)) = 3$

$g(1) = 3$

$g(3) = 3$

(d)  $(g \circ f)(-2) = 3$

$f(-2) = 1$

$g(1) = 3$

(e)  $(f \circ g)(0) = 2$

$g(0) = 0$

$f(0) = 2$

(f)  $(f \circ f)(0) =$

$f(0) = 2$

$f(2) = 3$

**Exercise #4:** Given the functions  $f(x) = 3x - 2$  and  $g(x) = 5x + 4$ , determine formulas in simplest  $y = ax + b$  form for:

(a)  $f(g(x))$

$$g(x) = 5x + 4$$

$$f(5x + 4) = 3(5x + 4) - 2$$

$$= 15x + 12 - 2$$

$$f(g(x)) = 15x + 10$$

(b)  $g(f(x))$

$$f(x) = 3x - 2$$

$$g(3x - 2) = 5(3x - 2) + 4$$

$$= 15x - 10 + 4$$

$$g(f(x)) = 15x - 6$$

**Exercise #5:** If  $f(x) = x^2$  and  $g(x) = x - 5$  then  $f(g(x)) =$

(1)  $x^2 + 25$

(3)  $x^2 - 5$

(2)  $x^2 - 25$

(4)  $x^2 - 10x + 25$

$$g(x) = x - 5$$

$$f(x - 5) = (x - 5)^2$$

$$(x - 5)^2 = (x - 5)(x - 5) = x^2 - 5x - 5x + 25$$

$$x^2 - 10x + 25$$

